

What is claimed is:

1. A method for providing an early warning of thermal decay, comprising:  
writing a test pattern to a magnetic disk, wherein said test pattern comprises at least one of a higher data density than a data density of user data and a location on said magnetic disk having a greater than average susceptibility to thermal decay;  
5 measuring an amplitude of a signal produced by reading said test pattern;  
storing said measured amplitude;  
reading said test pattern to obtain an observed amplitude of a signal produced by said test signal;  
comparing said measured amplitude to said observed amplitude; and  
10 producing a thermal decay warning signal if said comparison is unfavorable.
2. The method of Claim 1, wherein said step of writing a test pattern comprises writing information to at least a first track of said magnetic disk at a first frequency, wherein said first frequency is higher than a nominal data frequency for said track.
3. The method of Claim 2, wherein said at least a first track is located within a first zone, wherein said first frequency is a nominal data frequency for a second zone, and wherein said first zone is located towards an inside diameter of said magnetic disk relative to said second zone.



9. The method of Claim 1, wherein a portion of said magnetic disk having a greater than average susceptibility to thermal decay is created during manufacture of said magnetic disk, and wherein said test pattern is written to said portion of said magnetic disk.

10. The method of Claim 1, wherein said test pattern is written in accordance with a longitudinal recording scheme.

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11. A method for providing an early warning of thermal decay, comprising:  
writing a test pattern to a magnetic disk, wherein said test pattern comprises at  
least one of a lower data density than a data density of user data and a location on said  
magnetic disk having a greater than average susceptibility to thermal decay;  
5 measuring an amplitude of a signal produced by reading said test pattern;  
storing said measured amplitude;  
reading said test pattern to obtain an observed amplitude of a signal produced by  
said test signal;  
comparing said measured amplitude to said observed amplitude; and  
10 producing a thermal decay warning signal if said comparison is unfavorable.

12. The method of Claim 11, wherein said step of writing a test pattern  
comprises writing information to at least a first track of said magnetic disk at a first  
frequency, wherein said first frequency is lower than a nominal data frequency for said  
track.

13. The method of Claim 12, wherein said at least a first track is located  
within a first zone, wherein said first frequency is a nominal data frequency for a second  
zone, and wherein said first zone is located towards an outside diameter of said magnetic  
disk relative to said second zone.

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14. The method of Claim 11, further comprising identifying a sector of said magnetic disk at which a magnetic medium comprising an information storing portion of said magnetic disk is thinner than an average magnetic medium thickness of said magnetic disk, wherein at least a portion of said test pattern is written to said identified sector.

15. The method of Claim 14, wherein said sector is identified by measuring the amplitude of signals produced by a plurality of automatic gain control fields, and wherein said identified sector is associated with a one of said automatic gain control fields producing an amplitude that is less than a nominal automatic gain control field amplitude.

16. The method of Claim 11, further comprising, in response to said thermal decay warning signal, refreshing data stored on at least a portion of said magnetic disk.

17. The method of Claim 11, wherein a test pattern is written to each data storage surface of each magnetic disk included in a hard disk drive.

18. The method of Claim 11, wherein said steps of reading said test pattern to obtain an observed amplitude of said test signal, comparing said measured amplitude to said observed amplitude, and producing a thermal decay warning signal if said

comparison is unfavorable are performed periodically.

19. The method of Claim 11, wherein a portion of said magnetic disk having a greater than average susceptibility to thermal decay is created during manufacture of said magnetic disk; and wherein said test pattern is written to said portion of said magnetic disk.

20. The method of Claim 11, wherein said test pattern is written in accordance with a perpendicular recording scheme.

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21. A method for detecting thermal decay in a hard disk drive, comprising:  
identifying a sector of a magnetic disk having a magnetization that is less than an  
average magnetization for said magnetic disk;  
writing an early warning pattern to said sector;  
5 reading an amplitude of said early warning pattern to obtain a reference  
amplitude;  
storing said reference amplitude;  
reading an amplitude of said early warning pattern to obtain an observed  
amplitude;  
10 producing a thermal decay warning signal if said observed amplitude is less than  
said reference amplitude by more than a predetermined amount.

22. The method of Claim 21, wherein said sector is identified by observing an  
amplitude of a selected type of servo sector information written to said disk, wherein said  
15 identified sector is a sector associated with a one of said selected type of servo sector  
information having an amplitude that is at least about 10% less than an average amplitude  
of said selected type of servo sector information.

23. The method of Claim 22, wherein said servo sector information comprises  
automatic gain control information.

24. The method of Claim 21, wherein said step of identifying a sector of a magnetic disk having a magnetization that is less than an average magnetization for said magnetic disk comprises identifying an area of said disk having a magnetic media thickness that is less than an average magnetic media thickness of said magnetic disk, wherein said identified sector is a sector located in said identified area.

25. The method of Claim 21, further comprising producing an area of said magnetic disk having a magnetic media thickness that is less than an average magnetic media thickness of said magnetic disk, wherein said step of identifying a sector of a magnetic disk having a magnetization that is less than an average magnetization for said magnetic disk comprises identifying at least a first sector that is at least partially located within said area having a less than average magnetic media thickness.

26. The method of Claim 25, wherein said hard disk drive stores data according to a longitudinal recording scheme, and wherein said area having a less than average magnetic media thickness is located towards an inner diameter of said magnetic disk.

27. The method of Claim 25, wherein said disk drive stores data according to a perpendicular recording scheme, and wherein said area having a less than average media thickness is located towards an outer diameter of said magnetic disk.



28. The method of Claim 21, wherein said hard disk drive stores data according to a longitudinal recording scheme, and wherein said step of writing an early warning pattern comprises writing data to said identified sector of said magnetic disk at a frequency greater than a nominal data frequency for data stored on a track comprising said identified sector.

29. The method of Claim 21, wherein said disk drive stores data according to a perpendicular recording scheme, and wherein said step of writing an early warning pattern comprises writing data to said identified sector of said magnetic disk at a frequency less than a nominal data frequency for data stored on a track comprising said identified sector.

30. A method of detecting thermal decay in a magnetic storage device,  
comprising:

writing a test pattern having a greater susceptibility to thermal decay than a 1T  
pattern to a magnetic storage medium;

5 reading an amplitude of a signal produced by said test pattern to obtain a reference  
amplitude;

storing said reference amplitude;

reading an amplitude of a signal produced by said test pattern to obtain an  
observed amplitude;

10 comparing said reference amplitude to said observed amplitude; and

in response to an unfavorable comparison, producing a thermal decay warning  
signal.

31. The method of Claim 30, further comprising:

writing a first evaluation test pattern to said magnetic storage medium;

writing a second evaluation test pattern to said magnetic storage medium, wherein  
said test pattern is selected from at least said first and second evaluation test patterns.

32. The method of Claim 30, further comprising identifying a portion of said  
magnetic storage medium having a susceptibility to thermal decay that is greater than an  
average susceptibility to decay of said magnetic storage medium.

33. The method of Claim 32, wherein said identified portion of said magnetic storage medium is a portion of said magnetic storage medium having a less than average magnetic storage material thickness.

34. The method of Claim 30, wherein said magnetic storage device stores data according to a longitudinal recording scheme.

35. The method of Claim 30, wherein said magnetic storage device stores data according to a perpendicular recording scheme.

36. A hard disk drive, comprising:

a base;

a magnetic storage disk comprising a magnetic storage material and a plurality of data tracks;

5 a transducer head for reading and writing information to said data tracks, wherein said information comprises at least a first test pattern, and wherein said transducer head is movable in a radial direction with respect to said disk to address a selected one of said plurality of data tracks;

10 a voice coil motor, interconnected to said transducer head, for moving said transducer head with respect to said data tracks;

a controller, interconnected to said voice coil motor, for controlling a position of said transducer head with respect to said data tracks; and

15 a channel, interconnected to said transducer head, wherein an amplitude of a signal derived from said at least a first test pattern having a greater susceptibility to decay than user data located in a like data track encoded in at least a first of said data tracks and read from said at least a first data track is transmitted by said channel, wherein a thermal decay warning signal is generated if said amplitude of said signal derived from said at least a first test pattern is less than a reference amplitude.

37. The hard disk drive of Claim 36, wherein said at least a first test pattern is written to an area of said magnetic storage disk having a magnetic storage material

thickness that is less than a prescribed amount.

38. The hard disk drive of Claim 37, wherein said prescribed amount comprises a thickness that is less than about 90% of an average thickness of said magnetic storage material.

39. The hard disk drive of Claim 37, wherein said magnetic storage disk is formed having a magnetic storage material thickness that is intentionally reduced in said area of said magnetic storage disk having a magnetic storage material thickness that is less than a prescribed amount.

40. The hard disk drive of Claim 36, wherein said first test pattern is written to an area of said magnetic disk having an increased probability that magnetic domains included in said area will return to a direction occupied by said magnetic domain prior to being written with said at least a first test pattern.

41. The hard disk drive of Claim 36, wherein said hard disk drive stores data using a longitudinal recording scheme, wherein said at least a first of said data tracks is located in a first zone, wherein said data frequency of said at least a first test pattern corresponds to a data frequency for user data located in a second zone, and wherein said second zone is located farther from an interior diameter of said magnetic storage disk

than is said first zone.

42. The hard disk drive of Claim 36, wherein said hard disk drive stores data using a perpendicular recording scheme, wherein said at least a first of said data tracks is located in a first zone, wherein said data frequency of said at least a first test pattern corresponds to a data frequency for user data located in a second zone, and wherein said second zone is located farther from an outside diameter of said magnetic storage disk than is said first zone.

43. The hard disk drive of Claim 36, wherein said hard disk drive stores data using a longitudinal recording scheme, and wherein said at least a first test pattern comprises a data frequency that is greater than a frequency of said user data.

44. The hard disk drive of Claim 36, wherein said hard disk drive stores data using a perpendicular recording scheme, and wherein said at least a first test pattern comprises data that is less than a frequency of said user data.

45. The hard disk drive of Claim 36, wherein said hard disk drive stores data using a perpendicular recording scheme, and wherein said at least a first test pattern comprises a 12T pattern or greater.

46. The hard disk drive of Claim 36, wherein said hard disk drive stores data using a perpendicular recording scheme, and wherein said at least a first test pattern comprises a 24T pattern or greater.

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47. A hard disk drive, comprising:

a base;

a magnetic storage disk comprising a magnetic storage material and a plurality of data tracks, wherein at least a first of said plurality of data tracks has a reduced magnetization capacity;

a transducer head for reading and writing information to said data tracks, wherein said information comprises at least a first test pattern, and wherein said transducer head is movable in a radial direction with respect to said disk to address a selected one of said plurality of data tracks;

a voice coil motor, interconnected to said transducer head, for moving said transducer head with respect to said data tracks;

a controller, interconnected to said voice coil motor, for controlling a position of said transducer head with respect to said data tracks; and

a channel, interconnected to said transducer head, wherein an amplitude of a signal derived from said at least a first test pattern encoded in said at least a first of said plurality of data tracks and read from said at least a first of said plurality of data track is transmitted by said channel, and wherein a thermal decay warning signal is generated if said amplitude of said signal derived from said at least a first test pattern is less than a reference amplitude.



48. The hard disk drive of Claim 47, wherein said reduced magnetization capacity of said magnetic storage disk corresponds to a reduced magnetic storage material thickness.

49. The hard disk drive of Claim 48, wherein said area of said magnetic storage disk comprising said at least a first of said data tracks and comprising said reduced magnetic storage material thickness is formed at a predetermined location on said magnetic storage disk.

50. The hard disk drive of Claim 49, wherein said hard disk drive stores data according to a longitudinal recording scheme, and wherein said predetermined location is towards an inside diameter of said magnetic storage disk.

51. The hard disk drive of Claim 49, wherein said hard disk drive stores data according to a perpendicular recording scheme, and wherein said predetermined location is towards an outside diameter of said magnetic storage disk.

52. The hard disk drive of Claim 47, wherein said hard disk drive stores data according to a longitudinal recording scheme, and wherein said at least a first test pattern has a data frequency that is higher than a user data frequency for a like one of said plurality of data tracks.

